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Sensory and Perceptual Deprivation

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Scientific study of man's dependence upon his everchanging world of sensation and information is a recent undertaking. The collective wisdom of civilization long ago recognized variety as the spice of life. Yet only within the last decade has the study of human behavior within an unchanging sensory environment become a subject for study within the experimental laboratory. Initiating this development were the experiments of Hebb and his students at McGill University (8, 9, 14, 15, 16, 25, 26, 27, 29, 30, 31, 32, 40, 56). Their dramatic and highly publicized findings have kindled the interest of scientist and layman alike. At a time of public concern over alleged changes of behavior and even loyalities of prisoners of war in Korea, these investigators had examined by means of experiment one deceptively innocent aspect of any confinement experience -- the monotony of the surroundings. For as long as they were willing, experimental subjects were paid to do nothing. Their job was to lie on a cot, wearing frosted translucent goggles, hearing nothing but the noise of a fan, with cardboard cuffs extending beyond their fingertips. The subjects were comfortable, rested and fed upon request. The reported effects of such a limited perceptual environment were startling. Subjects:

-- were surprisingly unwilling to remain in the experiment
-- were said to experience vivid and compelling visions or hallucinations
-- were impaired in intellectual functioning and in perceptual organization, particularly upon re-entering the normal world.
-- were desirious of stimulation even in inane forms, and
-- were more effectively persuaded by lectures advocating the existence of ghosts, poltergeists and extrasensory perception phenomena.

These provocative experiments at McGill were completed just about 10 years ago. What has happened in the decade since? Research projects have mushroomed in the widespread laboratories of the continent, using various deprivation techniques. Soon after the McGill reports, and

the nearby work of Azima in Montreal (5, 6, 7) Lilly instituted a famous inquiry at the National Institutes of Health involving self-immersion in a tank of water in pursuit of minimal physical stimulation (38, 39). In 1956-57, Vernon at Princeton (64, 65) and my colleagues and I at the HumRRO lab in Monterey (44) undertook research using dark quiet cubicles as a technique for limiting sensory experience. Meanwhile, Solomon and his associates in Boston adopted the tank respirator as a means of diminishing variety of sensory input (36, 37, 52, 61, 70). In 1958, Ruff and Levy studied darkness in an anechoic chamber at Wright-Patterson Field (54, 55), and Goldberger and Holt used white noise and halved ping pong balls fitted over the eyes at New York University (21, 22, 34). Still other research programs have been inaugurated since 1958, such as those of Freedman and Goldblatt at Massachusetts General Hospital (18, 28), Zubek at the University of Manitoba (75, 76), Pollard and Jackson at the University of Michigan (53) and Shurley at the University of Oklahoma Medical Center (57); and Cohen, Silverman and Shmavonian at Duke (12, 58). Many other subsequent researches and dissertations have added to a burgeoning literature. By my latest count there are more than 200 research articles in this literature (45).

Clearly this has been a booming research area. Like any enterprise offering great promise to pursuants of many persuasions, there has been disappointment to the perhaps unrealistically high hopes and there has been solid achievement. Despite a plethora of terms and procedures to denote a monotonous sensory environment, most of the participants have been interested in the effects of a generalized state of reduced stimulation upon the organism and its behavior. Their approaches have been several. Sensory deprivation, in its many forms, has been viewed as a vehicle affording a better understanding of personality psychodynamics; as a functional analogue to the psychotic process of schizophrenia; as a potential treatment for mental illness; as an experimental manipulation relevant to neurophysiological, information processing or general behavioral theory; as an ingredient of that

complex of factors, inelegantly termed 'brainwashing', which may produce social change; and a means for selecting personnel and/or studying performance capacity for space travel. Studies proliferate at an accelerating rate. It is increasingly recognized, even as more suitable control groups are being instituted, that the placing of experimental Ss in artificially contrived sensory-poor environments is at best a complex operation. Change of diet, loss of freedom to smoke, reduced activity, and increased opportunity for sleep are factors usually confounded with diminished variety of sensory input. Limitation of experimental participation in most cases to volunteers, and the provision that the S may obtain early release from isolation pose formidable methodological problems in comparing reactions and behaviors of sensory deprived Ss to normal control Ss. These special safety precautions are usually visible to prospective Ss and their very presence may further stimulate the guessing game whereby the subject of psychological experimentation forms expectancies as to the behavior desired or expected of him. These manifold difficulties, however, do not preclude useful experimentation; rather they call for greater experimental ingenuity and underscore the need for the extra-experimental judgment implicit in all research endeavor.

What are the findings from this first decade of research in sensory deprived social isolation? To mention even some highlights, is to be arbitrarily selective. It should be acknowledged that this coverage is undoubtedly biased by my familiarity with the HumRRO experiments.[1] Monotonous environments of various types have been found to be tedious and difficult. Most Ss find sensory isolation difficult to endure, are tempted to withdraw and have little appetite to repeat the experience.

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[1] These experiments were carried out at the U. S. Army Leadership Human Research Unit at the Presidio of Monterey, California when their authors were employed by the Human Resources Research Office (HumRRO), Dr. Meredith P. Crawford, Director. This organization is an agency of George Washington University, under contract with the Department of the Army.

While in the diminished sensory environment, Ss have unusual and compelling reactions. They experience severe tedium, restlessness, anxiety, difficulty in mental concentration, blurring of the boundaries of sleeping and waking activities, feelings of irreality and changes in body schema. In general, these 'subjective' experiences resembling earlier descriptions of life during confinement have now been established by comparisons of experimental and control group data, seemingly without 'undue' contribution of such factors as Ss' sets and expectancies (50). Another of the hallmarks of sensory isolation is the extreme vividness of visual imagery. Frequently this imagery has the strong character of events occurring outside the person, and upon occasion these events are mistakenly interpreted as "real". However, in one study of ongoing visual experience, the sensations reported after 3 or 4 days of isolation were no more complex than those of Ss placed in total darkness for just an hour (42). This finding suggests a certain "normalcy" about these visual phenomena, somewhat novel to a literature abounding in psychotomimetic interpretation. Whether a given S is likely to attribute reality to his subjective visual experiences or even more generally, whether a given S will endure isolation, are prediction tasks which have been greeted with relatively little success. Some promising leads have been unearthed and much research is being directed to this question (3, 33, 35, 36, 48, 52, 58, 59). In the HumRRO studies, early response to isolation has proven indicative of later tolerance (41, 60). That is, people who exhibit relatively greater tedium and disorientation in time and those who become relatively more restless during the early stages of isolation, are very unlikely to withstand a much longer isolation period. These two measures, slow passage of time and extent of restless movement combined to correlate -.85 with success in enduring 96 hours of isolation. Still another early isolation behavior indicative of subsequent "staying power" was a S's "stimulus hunger", measured in a Princeton study by the degree to which the S utilized a "viewing box" dimly displaying geometric shapes (66). Subjects who frequently sought even this rudimentary visual experience were less likely to tolerate 72 hours of sensory deprivation.

Performance data during isolated confinement and after re-entry to the world of normally varied sensation has generally conformed to the initial research reports. Performance on intellectual tasks tends to decline during isolation (29, 46, 48, 49, 56, 73, 76). Post-isolation performance inpairment has been generally found, on ultra simple visuomotor coordinations as well as on more complex intellective tasks mediated by those coordinations (15, 29, 48, 56, 63, 68, 69, 73, 75). Yet rather few of the striking alterations of perceptual organization, such as disturbance of perceptual constancies, the bowing of plane surfaces, etc. reported from McGill (16), have been encountered in the later studies.

It has become increasingly clear, that performance of isolated Ss is not always impaired. There is some evidence that immediate memory span of isolated Ss may, in fact, exceed normal control performance (48, 73). Memory for a prose passage was better among Ss dark isolated for 24 hours at Princeton than among controls (23). In a HumRRO experiment, vigilance in the form of speedy reaction to infrequently presented tones was significantly superior for sensory deprived Ss as compared with controls (49, 51). In some studies verbal learning has been slightly facilitated by the isolation treatment (64, 65) although in others, the differences are lacking (4, 29, 48, 56, 73, 76). In another HumRRO experiment, learning was significantly superior for isolated Ss, when the learning consisted of changes in connotative meanings of words paired in a Pavlovian conditioning paradigm, such that word meanings almost literally "rub off" onto other words (43). Thus, at least certain kinds of performance, involving some forms of learning and memory improve in an impoverished sensory environment and ability to perform a rather boring vigilance task is enhanced, whereas carrying out particularly the relatively complex mental functions does seem to be retarded during monotonous isolation.

Still another category of 'positive effects' relates to desire for stimulation, in what may be termed 'stimulus reward' studies.

Perceptually isolated Ss at McGill had shown a heightened desire for even inane stimulation, such as radio commercials, and for the lectures on psychic phenomena (8, 29, 56). This has been borne out in one of the HumRRO studies by the consistently higher frequency with which Ss' request to hear information even when its content is contrary to their initial belief (47). When the stimulus rewards available to deprived Ss are quite simple and uninformative, for example, a pure tone or a white noise, request rates did not exceed the control group level (48). Thus sensory deprivation apparently increases the desire for informative stimulation, though not necessarily the desire for relatively redundant and meaningless stimulation.

First cousin to the stimulus reward experiment is the study of the impact of stimulation upon the isolated S. The McGill experiments had shown a greater change among isolated Ss in interest and belief in extra sensory perception topics (29, 56). Recent experiments have tended to confirm the greater impact of information upon isolated Ss, although other factors such as intelligence, may interactively modulate this effect (47, 62). In an experiment recently reported by Adams, Robertson and Cooper, individually prepared messages "aimed at facilitating insight, self-understanding and self-acceptance" were presented to psychiatric patients undergoing three hours of partial sensory deprivation alone without messages (1). In several studies, salubrious effects such as increased ego strength have been attributed to sensory deprivation, although the consensus here is not unanimous (10, 11, 13, 19, 20, 24). However, the Adams study suggests that a still more potent technique may result from the intrusion of therapuetic influence into sensory deprived isolation, utilizing the increased receptivity to environmental stimulation attendant to sensory monotony.

Two types of psychophysiological findings can be illustrated in the recent research of John Zubek at the University of Manitoba, namely, EEG indices of arousal and interaction of sense modalities. Zubek has

recently described progressive electroencephalographic changes during 14-day exposure to unpatterend light and white noise in an isolation setting (77). By courtesy of Dr. Zubek, figure 1 shows a systematic decrease in frequency of waves in the alpha range, for a typical subject. A downward shift in modal or average frequency can be seen from the before isolation baseline, to the point 7 days of perceptual isolation, 10 days, 12 days and 14 days of isolation. In figure 2, the alpha wave distributions shows the gradual recovery after isolation from this slowing effect. Notice that for this S, recovery is progressive and has not quite returned to baseline level even 7 days after termination of perceptual isolation. This downward shift was found for all 10 Ss in the isolation group. Even so, there were notable individual differences in the magnitude of the effect; some Ss shifted only a matter of one quarter of a cycle. Very interesting behavioral changes were noted in several of the Ss after isolation. Motivational losses were observed, described as "an inability to get started doing anyting", a "loathing to do any work requiring even the slightest degree of physical or mental exertion" and "a don't-give-a-darn attitude toward everything" (71, 77). This state, persisting for as long as 6 or 8 days in some Ss, is strikingly suggestive of the apathy and withdrawal syndrome found in individuals and groups in natural isolation settings. These EEG data are the clearest indication I have seen that reduced variety of sensory input over a prolonged period, in fact, produces psychophysiological changes which may be interpreted as a reduction in arousal level. Incidentally, an animal study by Fox has demonstrated that a similar change in alpha characteristically preceeds bar pressing for light by monkeys free to maintain sensory input on a self-demand basis (17).

Studies of another type seem to converge upon the conclusion that sensory deprivation leads to sensory hyperacuity in the same or in other modalities. Results from McGill and from Princeton showed an increase in threshold sensitivity to two point tactual stimuli and to pain stimuli, respectively, after sustained perceptual isolation

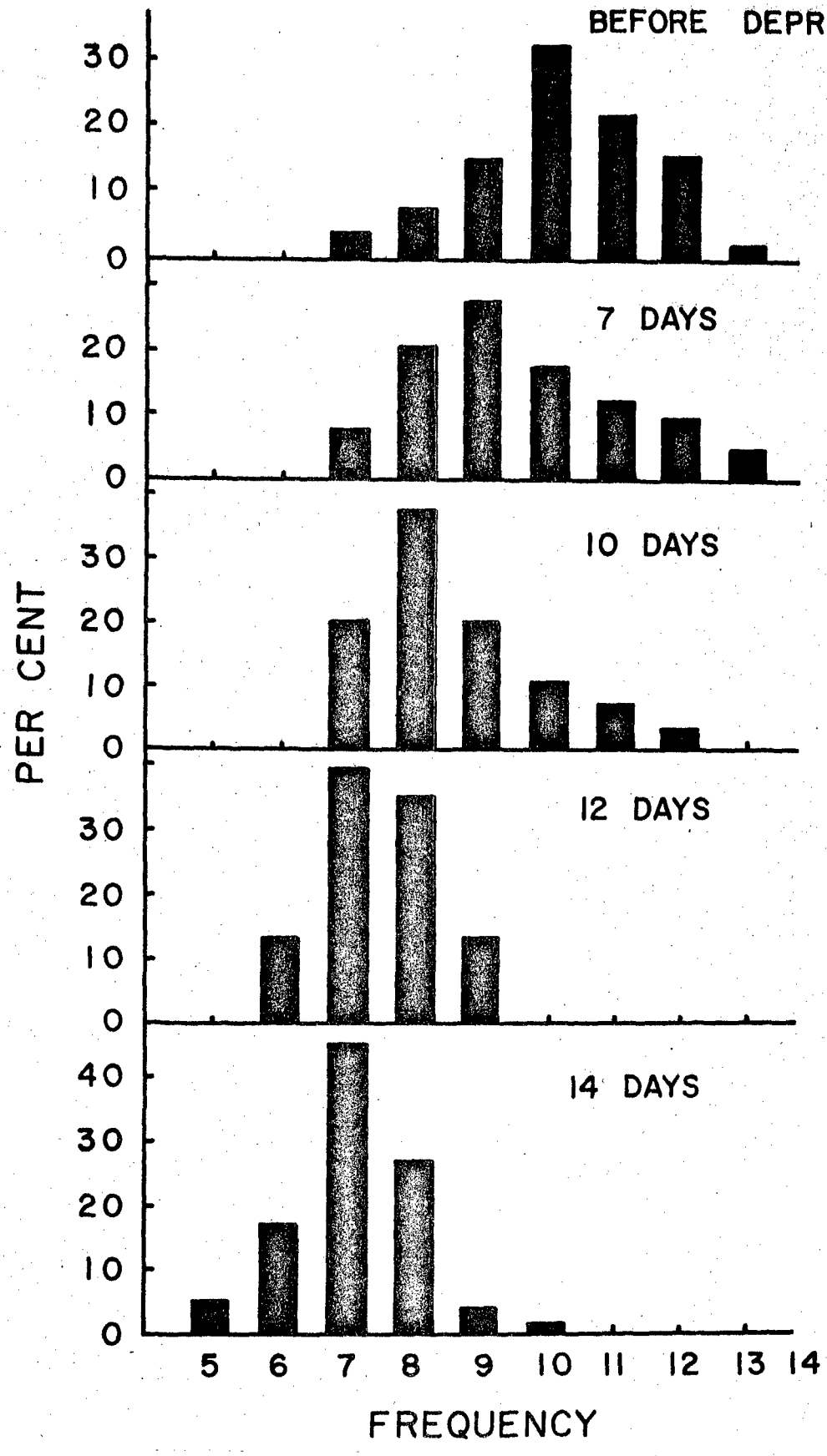

Fig. 1. Frequency spectrum for one subject before perceptual deprivation and at 7, 10, 12, and 14 days after the beginning of deprivation. The ordinate shows the percentage of time that waves of various frequencies appear in the occipital lobe tracings during a 300-second period. (Reproduced from figure 1 of Zubek, J. P., Welch, G., & Saunders, M. G. Electro-encephalographic changes during and after 14 days of perceptual deprivation. Science, 1963, 139, 490-492.

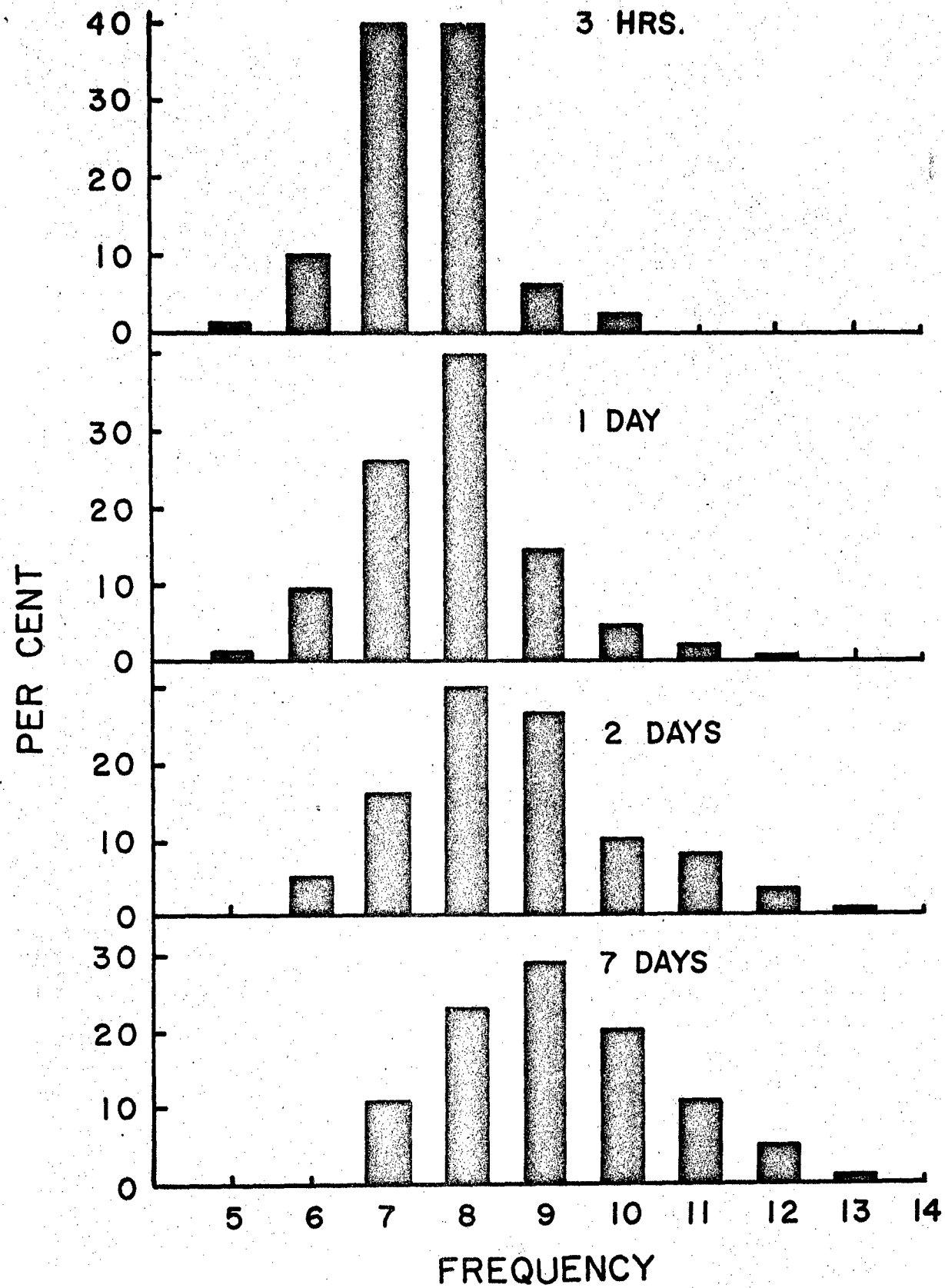

Fig. 2. Frequency spectrum for one subject at 3 hours, and at 1, 2, and 7 days after the completion of perceptual deprivation. (Reproduced from figure 2 of Zubek, J. P., Welch, G., & Saunders, M. G. Electroencephalographic changes during and after 14 days of perceptual isolation. Science, 1963, 139, 490-492.

and sensory deprivation (16, 67). Zubek has confirmed this increased tactual acuity after 7 days of uninterrupted perceptual isolation (72). In still another study by Zubek, Ss wore blindfolds for one week to limit visual experience, but were otherwise free to move around, to talk to other Ss, to play a radio and so on (74). After removing their masks, these Ss were more sensitive to tactual and pain stimuli than were non-blindfolded controls. These sensitivity increases persisted for several days. Thus, even visual deprivation alone led to cutaneous hyperacuity. Following this line of inquiry even further, Zubek has been able to demonstrate that even the deprivation of cutaneous stimulation on a circumscribed area of the forearm led to a super-sensivity of touch which persisted for several days (2). Although research data on the interaction of sense modalities has not always been unambiguous, these sensory deprivation findings give promise of improving our understanding of the inter-relationship of the modalities.

In summary, I have outlined a few of the results from the first decade of research upon sensory deprivation and perceptual isolation. Not to minimize current difficulties and disagreements in this area, it appears that we have experimentally consolidated and extended many of the early leads. The subjective stressfulness of severe monotny seems well established by controlled experiment, along with the phenomena of tedium, temporal disorientation, restlessness, difficulty in concentrating, feelings of irreality, and vivid visual imagery. Study of a broader spectrum of behavioral measures has identified a cluster of performances which appear to be facilitated by perceptual isolation, in addition to measures, e.g., intellectual functioning, which are likely to be impaired. The facilitation cluster includes: improvement in some aspects of memory and learning, and simple vigilance; heightened desire for and greater persuasive impact of meaningful stimulations; and perhaps simple sensory hyperacuities. Recent physiological data denotes a lowering of arousal with increasing duration of perceptual isolation. The great complexity of factors which are in effect manipulated in any experiment continues to plague attempts at simple explanation. Perhaps an emphasis upon these

difficulties might be the most accurate barometer of the state of the field. Yet it also seems true that some pattern is emerging among the findings, hopefully being detectable true signal among the noise.

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Encl: (1) Mr. Ravnitzky's request of 26 Feb 01
(2) BUMED ltr 5720/F01-100 Ser 00LD/0285 of 6 Jul 01

1. By reference (a), this Bureau responded to the Freedom of Information Act (FOIA) request in enclosure (1). This Bureau released, in its entirety, the Naval Medical Research Institute report, "Sensory and Perceptual Deprivation", by Thomas I. Myers, requested by Mr. Ravnitzky in enclosure (1). Enclosure (2) is provided for your information.

2. Per reference (b), you requested notification of the ultimate response to enclosure (1); therefore, enclosure (2) is provided.

3. Point of contact is Lieutenant J. L. Roper, JAGC, USNR, at (202) 762-3087 should you have any questions regarding this matter.

J. L. ROPER
By direction

6 JUL 2001,
LT ROPER, 202-762-3087,
SIGNED THIS AUG 247912,
IS APPROVED FOR PUBLIC
RELEASE. [illegible]

DEPARTMENT OF THE NAVY
BUREAU OF MEDICINE AND SURGERY
2300 E STREET NW
WASHINGTON DC 20372-5300

IN REPLY REFER TO

5720/F01-100
Ser 00LD/0285
July 6, 2001

Mr. Michael Ravnitzky
American Lawyer Media
105 Madison Avenue
New York, NY 10016

Dear Mr. Ravnitzky:

SUBJECT: FOIA - NAVAL MEDICAL RESEARCH INSTITUTE REPORT, SENSORY AND PERCEPTUAL DEPRIVATION

I am responding to your Freedom of Information Act (FOIA) request of February 26, 2001, seeking copies of various documents including a Naval Medical Research Institute report, "Sensory and Perceptual Deprivation," dated April 22, 1964. The Chief of Naval Operations forwarded your request to this office on June 6, 2001 for review, release determination, and direct response to you. I received your request on June 8, 2001.

The report, "Sensory and Perceptual Deprivation," by Thomas I. Myers, is responsive to your request and provided as enclosure (1).

All fees associated with the processing of this request have been waived.

If I can be of further assistance, you may reach me by Email at jlroper@us.med.navy.mil or by telephone at (202) 762-3087.

Sincerely,

J. L. ROPER
Lieutenant
Judge Advocate General's Corps
United States Naval Reserve
Freedom of Information Act/
Privacy Act Officer
By direction of the Chief,
Bureau of Medicine and Surgery

Enclosure: 1. "Sensory and Perceptual Deprivation" of 22 Apr 64